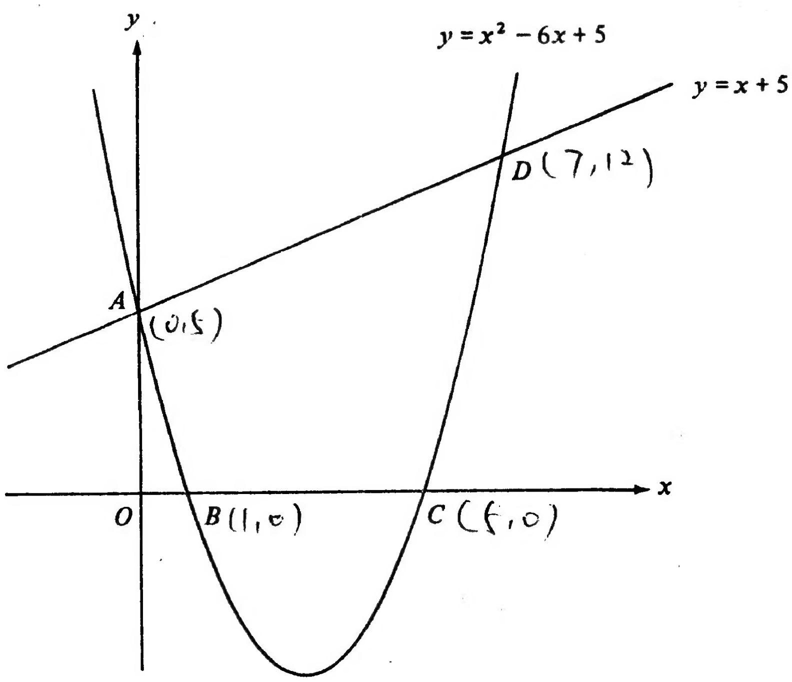
Solutions	Marks	
1. (a) Median mark = 49.5	1A	
(b)		

Marks	No. of Students
20 – 29	10
30 – 39	10
40 – 49	20
50 – 59	30
60 – 69	10

Solutions	Marks	
	1A+1A	1A for any two correct, 1A for the rest
Mean mark		
$= \dfrac{24.5 \times 10 + 34.5 \times 10 + 44.5 \times 20 + 54.5 \times 30 + 64.5 \times 10}{80}$	1M	Accept 25, 35, etc, denominator = Σf
$= \dfrac{3760}{80}$		
$= 47$	1A	Must show working
	5	
2. (a) $x \propto \dfrac{y^2}{z}$ $x = \dfrac{ky^2}{z}$ for some constant k	1A	For either
$18 = \dfrac{k(3)^2}{2}$	1M	Substituting for k
$k = 4$	1A	
i.e. $x = \dfrac{4y^2}{z}$		
(b) Putting $y = 1$, $z = 4$, $x = \dfrac{4(1)^2}{4}$	1M	Substituting for k
$= 1$	1A	
	5	
3. (a) $\dfrac{150000}{15} = £10000$	1A	
(b) $10000(0.146)\left(\dfrac{30}{365}\right)$	1A	
$= £120$		
Amount = £(10000 + 120)	1M	
= £ 10120	1A	Accept 10100 ~ 10120
(c) 14.50×10120		
= HK$146740	1A	Accept 146000 ~ 147000
	5	

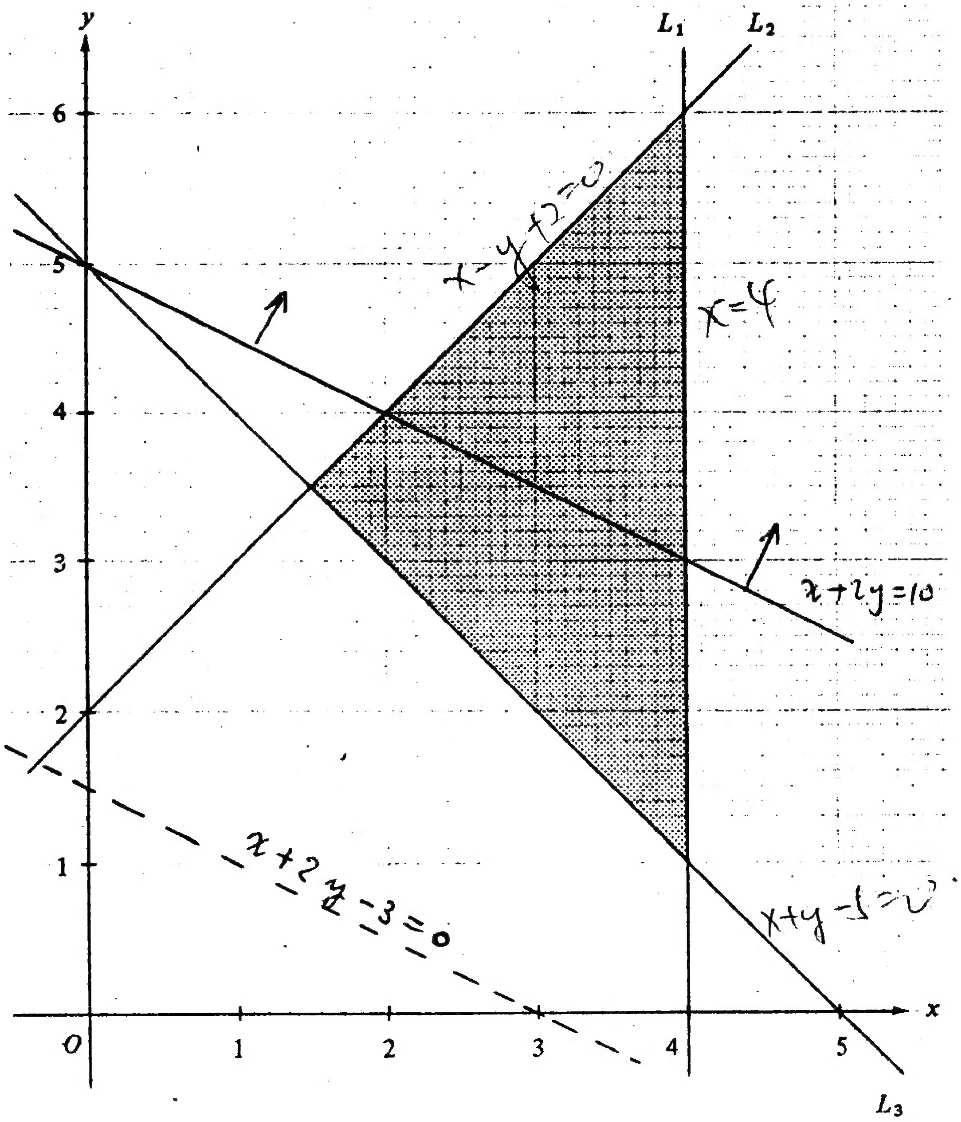
Solutions	Marks	
4. (a) $2a = 3b = 5c$		
$\frac{2a}{30} = \frac{3b}{30} = \frac{5c}{30}$	1M	
$\therefore\ a : b : c = 15 : 10 : 6$	2A	Correct ratio not in this form, 1A only
Alternatively		
$\frac{a}{b} = \frac{3}{2}$, $\frac{b}{c} = \frac{5}{3}$		
Writing $\frac{a}{b} = \frac{15}{10}$, $\frac{b}{c} = \frac{10}{6}$	1M	
$\therefore\ a : b : c = 15 : 10 : 6$	2A	See above
(b) $a = 15k$ $b = 10k$ $c = 6k$	1M	for either
$a - b + c = (15 - 10 + 6)k$		
$= 55$	1M	
$k = 5$		
$c = 30$	1A	
	6	
5. $\sin^2\theta - 3\cos\theta - 1 = 0$		
$1 - \cos^2\theta - 3\cos\theta - 1 = 0$	1M	$\sin^2\theta = 1 - \cos^2\theta$
$\cos^2\theta + 3\cos\theta = 0$	1A	
$\cos\theta(\cos\theta + 3) = 0$		
$\cos\theta = 0$ or $\cos\theta = -3$ (rejected)	1A+1A	Accept $\cos\theta = 0$
$\therefore\ \theta = 90°$ or $270°$ $\left(\frac{\pi}{2}\text{ or }\frac{3\pi}{2}\right)$	1A+1A	Withhold 1 mark for each extraneous answer
	6	

Solutions	Marks	
6. (a) Putting $x = 0$, $y = 5$.		
$\therefore$ $A = (0,5)$	1A	OR The coordinates of A are x=0, y=5
Putting $y = 0$, $x^2 - 6x + 5 = 0$		
$(x - 1)(x - 5) = 0$		
$x = 1$ or 5		
$\therefore$ $B = (1,0)$	1A	
$C = (5,0)$	1A	
(b) Putting $y = x + 5$ (or $x = y - 5$)		
$x + 5 = x^2 - 6x + 5$ $(y = (y - 5)^2 - 6(y - 5) + 5)$	1A	
$x^2 - 7x = 0$		
$x(x - 7) = 0$		
$x = 0$ or 7		
At D , $x = 7$	1A	
$\therefore$ $y = 12$	1A	
i.e. $D = (7, 12)$		

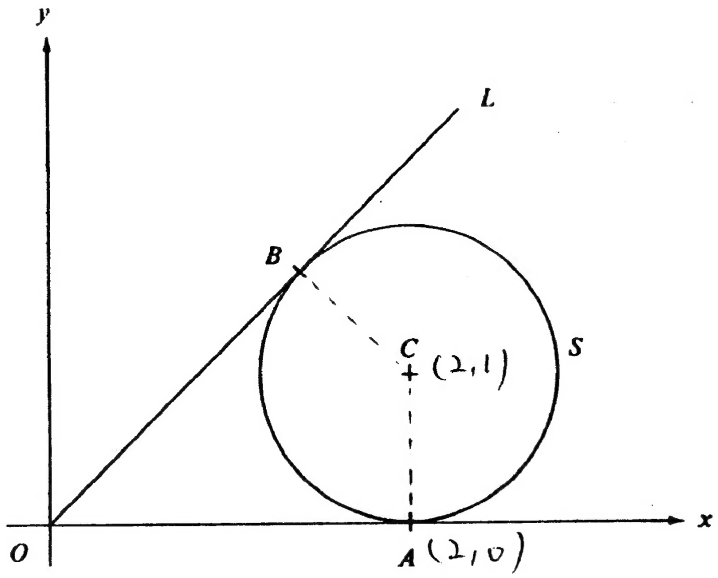


	Marks
	6
(a) $\alpha + \beta = -\frac{20}{10}$ $(= -2)$	1A
$4^{\alpha} \times 4^{\beta} = 4^{\alpha+\beta}$	1A
$= 4^{-2}$ $\left(= \frac{1}{16} = 0.0625\right)$	1A
(b) $\alpha\beta = \frac{1}{10}$	1A
$\log_{10}\alpha + \log_{10}\beta = \log_{10}\alpha\beta$	1A
$= \log_{10}\frac{1}{10}$	
$= -1$	1A
	6

Solutions	Marks	
8. (a) $L_2 : y - 2 = 1(x - 0)$		
$x - y = -2$ (or $x - y + 2 = 0$, etc.)	2A	2+1
$L_3 : \frac{x}{5} + \frac{y}{5} = 1$	1A	
i.e. $x + y = 5$ (or $x + y - 5 = 0$, etc.)		
	3	
(b) The region is determined by the inequalities		Withhold 1 mark if '=' omitted or for each extraneous constraint Note other equivalent forms
$x \le 4$	1A	
$x - y \ge -2$	1A	
$x + y \ge 5$	1A	
	3	
(c) (i) Drawing the line $x + 2y - 3 = c$	1M + 1A	<u>OR</u> Finding the values of P at any vertex
P is minimum at the point (4, 1) and the minimum value of $P = 4 + 2(1) - 3 = 3$.	1A	At (4,6), P=13 (4,1), P=3 (1.5,3.5), P=5.5
(ii) $x + 2y - 3 \ge 7$	1A	
$x + 2y \ge 10$		
Drawing $x + 2y = 10$ in the figure.	1A	
The possible range of values of x is $2 \le x \le 4$.	1A	
	6	



Solutions	Marks	
9. (a) $C = (2,1)$	1A	
$A = (2,0)$	1A	
	2	



Solutions	Marks	
(b) Putting $y = mx$ in S	1M	Let $\angle COA = \theta$
		$\tan\theta = \frac{1}{2}$ 1M
$x^2 + (mx)^2 - 4x - 2mx + 4 = 0$		$\angle BOA = 2\theta$ 1M
		$\therefore m = \tan 2\theta$ 1A
$(1 + m^2)x^2 - (4 + 2m)x + 4 = 0$	1A	$= \frac{2\tan\theta}{1 - \tan^2\theta}$ 1A
		$= \frac{2 \times \frac{1}{2}}{1 - \frac{1}{4}} = \frac{4}{3}$ 1A
For tangency, $(4 + 2m)^2 - 4(1 + m^2)(4) = 0$	1M	
$3m^2 - 4m = 0$	1A	
$m = \frac{4}{3}$ as $m \neq 0$	1A	
	5	
(c) (i) As OA, OB are tangents, $\angle OAC = 90°$ and $\angle OBC = 90°$	1	For either
$\therefore \angle OAC + \angle OBC = 180°$		
So O, A, C, B are concyclic.	1	
(ii) As $\angle OAC = 90°$, OC is a diameter of the required circle, whose centre $= (1, \frac{1}{2})$ and radius $= \frac{\sqrt{5}}{2}$.	1A+1A	
Equation of the circle is $(x - 1)^2 + (y - \frac{1}{2})^2 = \frac{5}{4}$	1A	
i.e. $x^2 + y^2 - 2x - y = 0$		
	5	

Alternatively

	Marks
(1) Let the circle be $x^2 + y^2 + ax + by + c = 0$. Values of a, b, c obtained by substitution	1A+1A+1A
(2) As OC is a diameter, the circle is $\frac{y - 0}{x - 0} \cdot \frac{y - 1}{x - 2} = -1$	2A
i.e. $x^2 + y^2 - 2x - y = 0$	1A

Solutions	Marks	
10. (a) (i) The probability that the candidate fails on the first attempt but passes on the second is $(1 - 0.7) \times 0.7$	1A + 1M	$1 - 0.7$ $p \times 0.7$
$= 0.21$	1A	
(ii) The probability of passing Part *A* in no more than 2 attempts is $0.7 + 0.21$	1M+1A	
$= 0.91$	1A	**Alternatively** 1A for any two: 0.6×0.7 $0.3 \times 0.6 \times 0.7$ $0.4 \times 0.6 \times 0.7$ $0.3 \times 0.4 \times 0.6 \times 0.7$ $p_1 + p_2 + p_3 + p_4 =$ 1M Ans. 2A
(iii) The probability of passing Part *B* in no more than 2 attempts is $0.6 + 0.4 \times 0.6$	1A	
$= 0.84$	1A	
$\therefore$ the required probability $= 0.91 \times 0.84$	1M	
$= 0.764$ (0.7644)	1A	
	10	
(b) No. expected $= 0.764 \times 10000$	1M	
$= 7640$ (7644)	1A	
	2	

11.

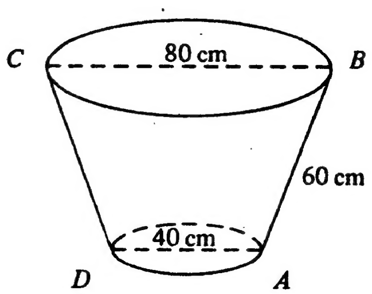


Figure 5a

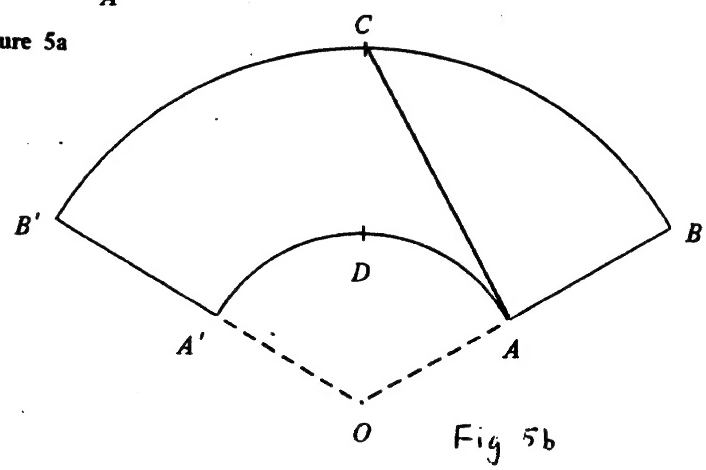
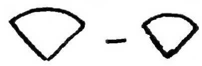
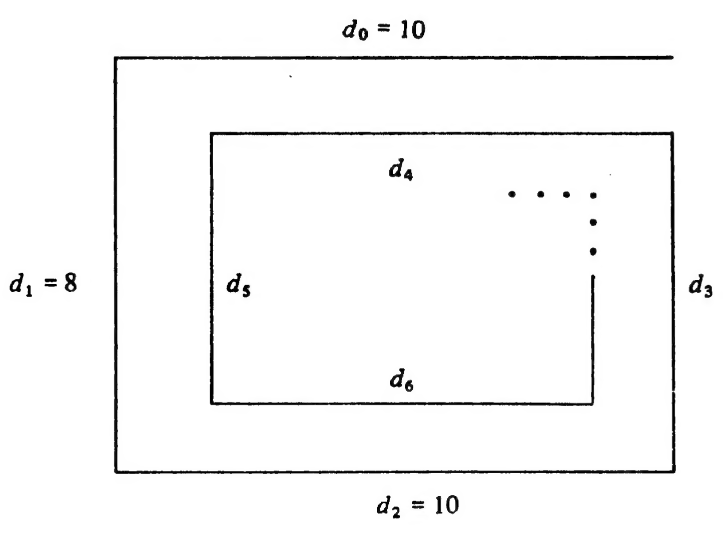


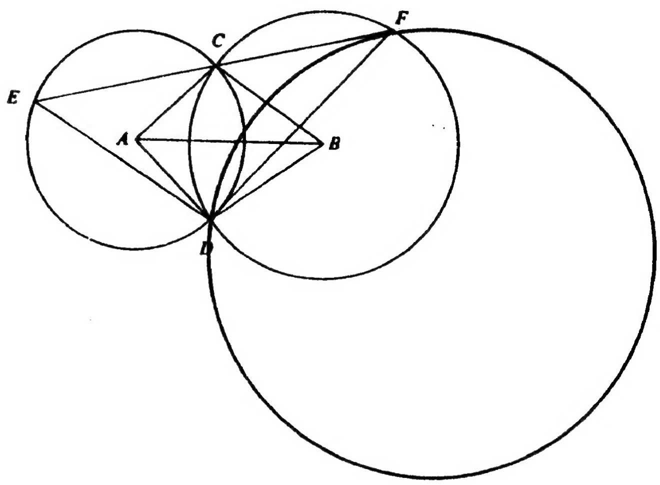
Fig 5b

Solutions	Marks	
11. (a) Let $\angle AOA' = \theta$		
$OA \times \theta = 40\pi$		
$OB \times \theta = 80\pi$	1A	For either
$\frac{OA}{OB} = \frac{40\pi}{80\pi} \left(= \frac{1}{2}\right)$	1A	
$\frac{OA}{OA + 60} = \frac{1}{2}$		
$OA = 60$ cm	1A	
$60\theta = 40\pi$ (or $120\theta = 80\pi$)	1M	
$\theta = \frac{2}{3}\pi$ ($= 120°$)	1A	
	5	
Alternatively		
From Fig.5a, by similiar triangles,		
$\frac{OA}{OB} = \frac{40}{80}$ $(= \frac{1}{2})$	2A	
$\frac{OA}{OA + 60} = \frac{1}{2}$		
$\therefore$ $OA = 60$ cm	1A	
Let $\angle AOA' = \theta$		
$60\theta = 40\pi$ (or $120\theta = 80\pi$)	1M	
$\theta = \frac{2}{3}\pi$	1A	
(b) Area of $ABB'A'$ $= \frac{1}{3}\pi 120^2 - \frac{1}{3}\pi 60^2$	1M + 1M	Area of sector 
$= 3600\pi \text{cm}^2$	1A	
	3	
(c) The shortest distance = distance between A and C in Figure 5b.	1M	Attempt to find AC
$\angle AOC = \frac{120}{2} = 60°$	1A	
$AC^2 = OA^2 + OC^2 - 2(OA)(OC)\cos 60°$	1M	$\angle CAO = 90°$ 1
$= 60^2 + 120^2 - 2(60)(120)(\frac{1}{2})$		$\sin 60° = \frac{AC}{OC}$
$= 10800$		$\therefore$ $AC = 60\sqrt{3}$ cm 1A
$\therefore$ $AC = 104$ cm (103.923)	1A	(= 104)
	4	

Solutions	Marks	
12. (a) $d_3 = 0.9\,d_1$		
$= 7.2$	1A	
$d_5 = d_3 \times 0.9 = 6.48$	1A	
$d_{2n-1} = 8(0.9)^{n-1}$	2A	
	4	
(b) $d_6 = 10 \times 0.9^2 = 8.1$	1A	
$d_{2n} = 10 \times 0.9^{n-1}$	1A	
	2	
(c) (i) $d_1 + d_3 + d_5 + \cdots + d_{2n-1}$		
$= 8 + 8(0.9) + 8(0.9)^2 + \ldots + 8(0.9)^{n-1}$		
$= \dfrac{8[1-(0.9)^n]}{1-0.9}$	1M	Attempting to sum as G.P.
$= 80(1-0.9^n)$	1A	
(ii) $d_2 + d_4 + d_6 + \cdots + d_{2n}$		
$= 10 + 10(0.9) + 10(0.9)^2 + \cdots + 10(0.9)^{n-1}$		
$= \dfrac{10[1-(0.9)^n]}{1-0.9}$		
$= 100(1-0.9^n)$	1A	
	3	
(d) $d_0 + d_1 + d_2 + d_3 + \cdots$		
$= 10 + (d_1 + d_3 + d_5 + \cdots) + (d_2 + d_4 + d_6 + \cdots)$	1M	Grouping even and odd terms
$= 10 + \dfrac{8}{1-0.9} + \dfrac{10}{1-0.9}$	1M	Either infinite sum
$= 190$	1A	
	3	



Solutions	Marks
13. (a) Consider $\triangle ABC$ and $\triangle ABD$.	
$AB = AB$ (common side)	1A
$BC = BD$ (radii of the same circle)	1A
$CA = DA$ (radii of the same circle)	1A
$\therefore \quad \triangle ABC \cong \triangle ABD$ (SSS)	3
(b) (i) $\angle CAD = 2\angle FED$ (= 110°)	1M
$\angle CAB = \frac{1}{2}\angle CAD = \angle FED$	
$= 55°$	1A
$\angle ABC = 180 - 95 - 55$	1M
$= 30°$	1A
$\therefore \quad \angle EFD = \angle ABC$	
$= 30°$	1A
(ii)(1)	



Solutions	Marks	OR	
A labelled diagram showing a cirlce through D touching CF at F .	1A		
(2) Through F draw a diameter FG . Join DG .		**OR**	
$\angle DGF = 30°$ ($\angle$ in alt. segment)	1A	$\angle DGF = 30°$	1A
$\angle FDG = 90°$ ($\angle$ in a semi-circle)	1A	$\angle DFG = 60°$	1A
$\frac{DF}{FG} = \frac{1}{2}$ (= sin30°)		$\therefore \angle FDG = 90°$	
i.e. $FG = 2DF$	1A	$FG = 2DF$	1A
	9		

Alternatively	
Through F and D, draw the radii FO and DO .	
As $OF \perp CF$, $\angle DFO = 90° - 30° = 60°$.	1A
As FO and DO are radii of the same circle,	
$\angle FDO = 60°$	1A
$\therefore \quad \triangle DFO$ is equilateral	
The diameter $= 2 \times FO = 2 \times DF$.	1A

Solutions	Marks	
14. (a) Consider $\triangle AGH$.		
$GH = 1000\sin\theta$ m	1A	
$AH = 1000\cos\theta$ m	1A	
	2	
(b) $\angle HAB = 30°$ (or $\angle AHB = 60°$)	1A	
$BH = AH\sin 30°$	1A	$BH = GH$ $= 1000\sin\theta$ 1M
$= 1000\cos\theta\sin 30°$		
$= 500\cos\theta$ m	1A	
Since $\angle GBH = 45°$, $BH = GH$	1M	
$500\cos\theta = 1000\sin\theta$		
$\tan\theta = \frac{1}{2}$		
$\theta = 26.6°$ (26.565)	1A	Accept 26°34′ ~ 26°36′
	5	
(c) $EF = AB = AH\cos 30°$		
$= 1000\cos 26.565° \times \cos 30°$		
$= 774.597\text{m} \approx 775\text{m}$	1A	Accept 774m
$BE = CE$		
$= DF$		
$= 800$		
$EH = 800 - 500\cos 26.565°$		
$= 352.786 = 353\text{m}$	1A	
$\tan\angle FHE = \frac{774.597}{352.786}$ $\left(\text{or } \frac{775}{353}\right)$	1M	
$\angle FHE \approx 65.5°$ (or $\angle EFH = 24.5°$)	1A	65°29′ ~ 65°30′ (24°29′ ~ 24°30′)
G is S65.5°E of D (or 114°)	1A	
	5